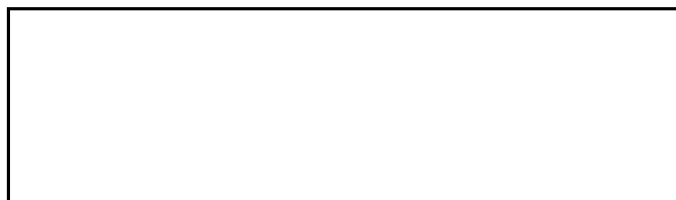


STAT

9 January 1970

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Work Completed

Study Report on 552A-101 Alignment and Rework 12/3/69

STAT

Reference: [redacted] Number 1913

Gentlemen:

The subject study report was hand submitted on 3 December 1969 and findings were discussed with your cognizant technical representative.

Price estimates covering report recommendations for Alternates A and B are confirmed as follows:

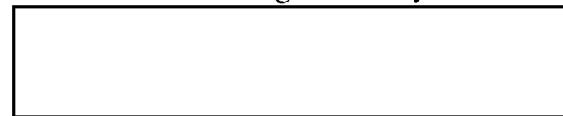
APPROACH A

STAT

Return 552A-101 to [redacted] for disassembly, complete bottom up rework and alignment to $\pm 2 \frac{1}{2}$ microns $\pm 0.05\%$ of distance traveled as a design goal (See Special Report, copy attached herewith). This would include packaging and shipping to [redacted] on air ride truck. Rework at [redacted] with return shipment reinstallation and realignment at original site. Miscellaneous materials including new ways and ball bushings (but not including new ball screws)

STAT

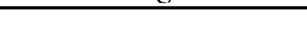
STAT

APPROACH B

Rework and align existing 552A-101 on site to achieve an accuracy of ± 8 microns $\pm .005\%$ of distance traveled as a design goal. This would require an estimated six man weeks of field work, plus plant engineering and shop support as well as travel, per diem and [redacted] miscellaneous materials. [redacted] propose undertaking this task under time, material and fee basis, with a total estimated

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Declass Review by NGA.

-2-

Two additional possibilities for improving system accuracies were briefly discussed.

APPROACH A2

Return unit to plant and rework per A, above, but in addition, install twin format laser interferometer measuring systems to provide 552A-101 with + 1 micron + .003% accuracy capability.

STAT This approach would require additional mirror and sensor mounting hardware for modified standard [] 770 Interferometer System providing a square or sine wave output similar to that of the present DRC encoders, except each count will represent 1/2 wavelength of laser light (approximately 12 microinches or 0.3 microns). Measuring system includes four interferometers and two shared lasers with mirror and mounting brackets.

STAT []
APPROACH B2

Realign 552A-101 per B, above, and in addition, install laser interferometer on site. Further evaluation of the work tasks indicates that field installment would not be economically practical at this time. Hence, no cost estimate is submitted for this approach.

This submission with additional copies of Inspection Report and price estimates complete requirements of Contract Number [] STAT

If additional information is required, please contact the undersigned.

Very truly yours,

STAT []
STAT []
Program Manager

MJM:lmr
Enc.
STAT []

STAT

Approved For Release 2005/05/20 : CIA-RDP78B04770A001700070018-9

50037

Rec'd 12/3/69

SPECIAL STUDY REPORT COVERING

INSPECTION OF 552A-101

To determine existing alignment condition and feasibility of increasing system's measuring accuracies.

STAT

CONTRACT NUMBER:

STAT

Approved For Release 2005/05/20 : CIA-RDP78B04770A001700070018-9

Summary of 5 and 6 November 1969 field trip inspection findings:

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X-Y objective motions were collimated both for azimuth and elevation. Measurements were also made using 9 X 18 inch calibrated grid. Right format shows the following gross readings and observations:

ITEM	Δ X AXIS (8") LEVER	Δ Y AXIS (5") LEVER
Azimuth	<u>+</u> 4 seconds ARC	<u>+</u> 7 seconds ARC Accuracy
Elevation	-4 to + 32 seconds	<u>+</u> 5 seconds
Coordinate Measurements	+ 10 μ to - 39 μ	-5 μ to +28 μ
Perpendicularity	600 μ	Roughly adjusted same to approximately 160 microns of being perpendicular
Backlash over Random Points	0 to 2 μ Operator positioning error possible	0 to 2 μ
Drift Repeatability	3 to 4 microns after 1/2 hour warm up. No drift recorded after approximately 1 - 2 hours of warm up. Warm up precautions must be observed.	
Screw Errors	Contained in composite coordinate error readings above. Records show screws good to 5 microns/foot and within tolerance over incremental 3" and 4" distances.	
Cable Forces	No errors in repeatability were noted under normal operation. Manually induced forces gave 1 to 10 micron movements.	
Level Check	System was found to be reasonably level and not the cause of drift.	

PURPOSE OF FEASIBILITY STUDY

To determine the condition of existing 552A-101 Viewer System and what approach could be taken for rework and alignment to provide mensuration capability.

Namely:

2.5 microns \pm .005% of distance traveled

- 1) Analyze historical data, inspect and test 552A System on site.
- 2) Submit report of findings

ITEM	Δ X AXIS (8") LEVER	Δ Y AXIS (5") LEVER
Focus Variations	Due to variations in way elevation and possibly platen being out of level	
X-Y Motion Stuttering	Normal at certain cross over speed cleaning and lubrication will help	
High Magnification Illumination	Solenoids not working; left objective turret binding;	
Film Guide	Repair Required	

Analysis of Archive Records and Historical Data

Investigation of drawings and inspection records show that all components such as; screws, ways, ball bushings, bearings, carriages and miscellaneous components met all tolerances and quality standards.

552 PTD way mounts and carriage members were likewise selected, form fitted, lapped and/or finish honed, and scraped and finally aligned with collimators to within 2 seconds of arc so that final composite accuracies would fall within the targeted requirements. In spite of these precautions, additional system alignments were required at the final installation to cancel out certain inaccuracies due to relocation, releveing and other composite errors.

General Background History

The 552A Models 101, 102, 103 and 104 were built as multi-purpose comparison and viewing instruments with special optical switches and drives to permit multi-mode viewing, scale matching and scanning film chips or double spooled imagery. The 552 point transfer device was likewise equipped, but in addition, contained extras such as selected components; precision machining and alignment to provide accurate mensuration capabilities as well as laser marking optics and associated precision alignments. All 552 and 552A Models were equipped with cast iron base structures and 5/4 per foot lead screws. Because of accuracies required by the 552PTD considerable work was put into the initial machining, preparation and collimation of all ways and mounts.

SUMMARY

Based on inspection findings and investigations summarized above, it is obvious that alignment of ways, carriages, and miscellaneous components is required to improve the system measurement accuracies.

Y Way collimation plot of elevation shows linear Y measurements can be improved by re-aligning Y ways.

X Way collimation plot likewise shows that linear X measurements can be improved by re-aligning X ways.

Y Way Azimuth collimation plot indicates rough high spots that should be removed to improve measurement accuracies.

Perpendicularity 600 micron shift was recorded; this was lowered to about 160 microns during inspection, but will require further alignment and work to meet the design goal accuracies.

It naturally follows that the degree of accuracy set as a working goal or target will determine the approach taken.

APPROACH A

STAT A ± 2.5 microns $\pm .005\%$ system would require return to
[] plant facilities for complete disassembly, inspection,
probable replacement of ways, bushings, rework and lapping of way
mounts, recollimation and alignment of bare ways upon surface plate
to establish a basic in line working plane. Re-assembly and test
to determine final accuracies are within ± 2.5 microns $\pm .005\%$ as
a design goal. Correction cams could possibly be required.

System would then be shipped and installed at final site
and retested. While the lead screws will be cleaned, lubricated
and inspected, replacement of same is not contemplated or estimated
based on feasibility study. Task would require approximately 16-20
weeks from receipt of system to final re-installation and test at
site.

APPROACH B

A ± 8 microns $\pm .005\%$ system would be reworked and aligned at Washington site without complete disassembly and bottom up alignment as would be provided at factory facility. Tasks would include:

1. Complete cleaning and lubrication
2. On spot adjustments and recollimation of all ways and carriages to best possible configuration for orthogonality, flatness, and straightness.
3. Test to determine final accuracies are within ± 8 microns $\pm .005\%$ as a design goal. It is anticipated that this ± 8 micron accuracy may be improved somewhat after certain items are more critically inspected and minute imperfections are corrected.
4. Submit short report at completion of 6 man weeks of field work and tests.

Cost estimates for above will be based upon:

1. Normal daytime working hours, Monday through Friday.
2. Support from your personnel and shop facilities when and if necessary to expedite work.
3. Electronic readout equipment is available and in working condition.
4. No major components require replacement.
5. will employ a grid to check out the format over 25 calibrated points (traceable to Bureau of Standards). No formal calibration is included.

552A-101 GROSS PLOT (RIGHT FORWART)
INSPECTION FINDINGS NOV. 5-6, 1965 by MHC & M.D.
GROSS ADJUSTMENT FOR 600 MICRON PERPENDICULARITY

